Sub-task from Avoided Conversion Sub-group **June 18, 2008**

Support building materials with low embodied greenhouse gas emissions as way to keep working forests as forests

Embodied Greenhouse Gas Emissions are the emissions associated with the extraction, processing, transportation, construction and disposal of materials. It is very closely associated with embodied energy, which aggregates the total amount of energy used in the above-mentioned stages. Until fairly recently it was assumed that embodied energy/embodied GHG emissions of building materials were minimal compared to the energy used during the operational life of a building. However, numerous studies have concluded that embodied energy of building materials are equivalent to many years' worth of operating energy. For example, Perez-Garcia et al (2005) found that embodied energy accounted for over 10% of the total energy consumed during the life of a house. Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) found that embodied energy is equivalent to roughly 15 years of operating energy (Reardon et al 2005). This impact becomes more significant as efficiency increases in operating energy.

Green building practices and standards should aim to reduce total building energy use/greenhouse gas emissions. To do so, the embodied greenhouse gas emissions associated with building materials should be included. Although some green building standards (Green Globes, NAHB Green Building Standard[1]) include life cycle assessment, the LEED standards do not. Currently Washington State has a number of legislative requirements for use of LEED in public buildings.[2] Washington State should either encourage USGBC to revise the LEED standards to include this important category of greenhouse gas emissions or adopt legislation that encourages more robust green building practices.

[1] To be released in 2008

[2] Execute Order 05-01 requires LEED silver standards for WA public buildings. High-Performance Public Buildings bill (Chapter 39.35D RCW, requires all new state-funded facilities over 5,000 sq. ft to meet green building standards. More specifically, major office and higher education facility projects will be required to achieve US Green Building Council LEED Silver certification. New K-12 schools will be required to meet either the Washington Sustainable Schools Protocol (WSSP) or LEED certification.

More background:
On a large scale, the difference in material selection is significant.

- If 1.5 million housing starts in the U.S. used wood-framed houses rather than non-wood building systems, 9.6 million metric tons (mt) CO_2e per year would be kept out of the atmosphere. This savings is equivalent to keeping roughly two million cars off the road for one year (Miner et al, 2006)
- Using wood-framed housing in the 1.7 million housing starts in Europe[3] would save 35-50 million mt CO_2e, which would be enough to contribute 11-16% of the emissions reduction needed for Europe to meet the Kyoto requirement (Eriksson 2003).
- A 17% increase in wood usage in the New Zealand building industry could result in a reduction of 484,000 mt CO_2e. This reduction is equivalent to a 20% reduction in carbon emissions from the New Zealand building industry and roughly 2% of New Zealand's total GHG emissions (Buchanon and Levine 1999).

ATHENA EcoCalculator- The ATHENA EcoCalculator for Assemblies compiles greenhouse gas emissions for different material building assemblies (e.g. exterior walls, roofs, windows, floors, interior walls) based on detailed life cycle assessments using the ATHENA Impact Estimator for Buildings. The ATHENA Impact Estimator, in turn, uses date from the US Life Cycle Inventory Database and ATHENA's own datasets (see http://www.athenasmi.ca/tools/docs/EcoCalculatorFactSheet.pdf for more detail). The EcoCalculator is used by architect firms and universities and can be used for new construction, retrofits and major renovations in industrial, office or residential design.

The ATHENA EcoCalculator calculates the average embodied greenhouse gas emissions, *per square foot (square meter)*, for each building assembly[4]. This then can be scaled up to the square footage of an average house. A builder can then enter in the square footage of a particular material assembly type that will be used in the building. The embodied greenhouse gas emissions will be automatically calculated in ATHENA and summed across all assemblies (e.g. floor, interior wall, exterior wall, roof, windows).

The difference in embodied greenhouse gas emissions between the average building assembly and the builder's assembly can be readily quantified.

[3] Currently only 5% of new construction in Europe uses wood framing

[4] Note: this average should not be a weighted average based on current market share but rather the physical average of different options of assembly types. It is important to recognize that current market share today does not lock-in current market share in the future, and the benefits should actually accrue to the lowest carbon footprint materials.